

# PATENT SPECIFICATION

(11) 1263 975

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## DRAWINGS ATTACHED

- (21) Application No. 8788/69 (22) Filed 18 Feb. 1969  
 (31) Convention Application No. 706 898 (32) Filed 20 Feb. 1968 in  
 (33) United States of America (US)  
 (45) Complete Specification published 16 Feb. 1972  
 (51) International Classification B 01 f 3/08 // 13/00  
 (52) Index at acceptance  
 B1C 14 4  
 A2D 2L 2M 3A



## (54) METHOD AND APPARATUS FOR BLENDING LIQUID ADDITIVE INTO A LIQUID STREAM

(71) We, JOS. SCHLITZ BREWING COMPANY, of 235 West Galena, Milwaukee, Wisconsin, United States of America, a corporation organized and existing under the laws of the State of Wisconsin, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

Perishable food materials such as fruit juices, beer, soft drinks and the like are normally sterilized by heat treatment after packaging. The heat sterilization consists of heating the packaged material to a temperature in the range of 140 to 180°F. to destroy any organisms which might be present in the material. Heat sterilization requires a substantial investment in capital equipment, for it necessitates a relatively large heating zone, heating equipment and a conveying mechanism to automatically convey the bottles or cans through the heating zone.

Recently there has been increased activity in the use of liquid sterilizing agents as a substitute for the traditional heat sterilization of perishable materials. Certain materials such as diethyl pyrocarbonate or mixed anhydrides are not only effective sterilizing agents but are capable of breaking down or decomposing into products which are comparable with the perishable material and thus will not adversely affect the flavour or odour of the material.

While diethyl pyrocarbonate and other mixed anhydrides are effective sterilizing agents, they are soluble in water, e.g. with solubility less than 1% by weight at 20°C., and thus it is difficult to adequately dissolve the sterilizing agents in the beverage or perishable material at the flow rates used for commercial production.

The present invention provides a method of blending a liquid additive into a flow stream of a liquid material, (e.g. a liquid sterilizing agent into a flow stream of a perishable liquid), comprising the steps of continuously

causing a stream of the liquid material to flow through a flow path, subjecting a body of the liquid additive to the pressure of an inert gas, said pressure being above that of the liquid material in the stream, continuously withdrawing additive from said body and conducting it to the stream of liquid material, atomizing the additive in the stream, and mechanically agitating the stream after the introduction of the additive.

The invention also provides an apparatus for blending a liquid additive into a liquid material, comprising first conduit means to convey a stream of the liquid material, injector means located in the first conduit means for injecting the liquid additive into the stream, a storage tank to contain the liquid additive, means for subjecting the additive to an inert gas at a pressure above that of the liquid material in the first conduit means, second conduit means connecting the storage tank to the injector means, said injector means including means for atomizing the additive in the flow stream of the liquid material, and mechanical agitating means in the first conduit means for agitating the stream of liquid material after the introduction of the additive. For convenience the following description illustrates the invention in terms of blending a liquid sterilizing agent with a perishable liquid.

The addition of the sterilizing agent to the perishable material is preferably controlled by a valve in the flow line of the sterilizing agent and the valve is preferably controlled by a controller unit which compares the actual, proportional flow rate or concentration of sterilizing agent to perishable material with a preset proportional flow rate or concentration and generates an error or feedback signal in proportion to the difference between the actual and preset values. This error signal is then fed back to the valve mechanism and acts to adjust the flow rate of the sterilizing agent to provide the desired final concentration of the sterilizing agent in the perishable material.

As a safety feature, an alarm system may be employed to provide a signal when the concentration of the sterilizing agent in the material falls outside of preset limits, and a further provision is incorporated to immediately shut off the flow of both the perishable material and the sterilizing agent if the concentration of the sterilizing agent lies above a maximum present limit.

In its preferred embodiments, the present invention provides an inexpensive yet effective method of adding small amounts of a relatively insoluble material to the flow stream of a perishable material with the addition being accurately and automatically controlled within precise limits of concentration.

The use of the liquid sterilizing agent eliminates the costly heat sterilization equipment normally employed to sterilize perishable materials, such as malt beverages, soft drinks, wine, and fruit juices. As the sterilizing agent is merely added to the flow stream of the material as it flows to the filling machine, no additional time is required for sterilization, as opposed to the conventional heat sterilization process which requires a substantial period during the overall bottling process for sterilization.

The invention is further described by way of example, with reference to the accompanying drawings, which illustrate the best method presently contemplated of carrying out the invention.

In the drawings:

Fig. 1 is a schematic flow diagram of the process of the invention:

Fig. 2 is a vertical section of the additive injector unit; and

Fig. 3 is a view taken along line 3—3 of Fig. 2.

Referring to Fig. 1, a perishable liquid, such as fruit juice, beer, soft drinks, wine, or the like, is conveyed through a line 1 and a magnetic flow meter 2 is located in line 1 and measures the rate of flow of the liquid passing through the line and generates an output signal in proportion to the flow rate. Beverages such as beer and wine are relatively clear liquids while fruit juices and some soft drinks may contain particulate material.

A liquid sterilizing agent, such as diethyl paracarbonate, or mixed anhydrides, such as those disclosed in specifications Nos. 1,200,210 and 1,205,146, is introduced into the perishable material through a line 3 which is connected through an injector unit 4 to line 1. Located downstream of the injector unit 4 is a mechanical blender or homogenizer 5 which is driven by motor 6. The sterilizing agent is added to the beverage in the injector unit 4 and thereafter the blender, by mechanical action, serves to fully dissolve the sterilizing agent in the perishable material.

The sterilizing agent is contained within a storage tank 7 and line 3 is connected to the

lower end of the tank. The flow of the sterilizing agent through the line 3 is controlled by a pneumatically-operated valve 8 to automatically adjust the flow of the sterilizing agent in line 3 to the desired rate.

The sterilizing agent in tank 7 is maintained at a pressure of at least 5 psi, and preferably in the range of 25 to 35 psi, above the pressure of the beverage in line 1. The pressure is applied to the sterilizing agent by an inert gas, such as nitrogen, which is introduced into the headspace of the tank 7 through a line 9. The pressure of the nitrogen or other gas is regulated by a conventional pressure regulating valve 10 which is connected in the line 9. The valve 10 serves to sense the pressure in the headspace and regulate the flow in line 9 so that the pressure of the gas on the sterilizing agent will remain relatively constant at all times. The portion of line 3 located immediately beneath tank 7 is enlarged to define a reservoir 11 and a conventional photo-electric cell 12 is mounted in the wall of the reservoir and senses the presence of liquid in the reservoir. Cell 12 is connected through an electrical circuit to an alarm, such as a light or horn, and, in addition, the cell 12 is connected in a second electrical circuit with the filling machine. When the liquid level in reservoir 11 falls beneath the level of photo cell 12, the first circuit is closed to sound the alarm and the second circuit is opened to stop operation of the filling machine. This ensures that there will be no flow of inadequately sterilized material to the filling machine.

Located within the line 3 is a flow rate measuring unit 13 which measures the flow of the sterilizing agent through the line 3 and generates an output signal in proportion to the flow rate. The sterilizing agent is added to the perishable material in very minute quantities, generally in the range of 0.0001 to 2 gms./liter so that under production conditions the flow of the sterilizing agent through line 3 will generally be in the range of 1 to 40 ml. per minute. As the flow rate of the sterilizing agent is exceedingly low, a measuring unit must be employed which is capable of accurately measuring these low flow rates. As shown in Fig. 1, a pressure differential type of unit is employed in which the sterilizing agent in line 3 is passed through an orifice or restricted opening and the pressure is measured on either side of the orifice in line 3. The pressure differential is utilized as an indication of the flow rate of the sterilizing agent within line 3.

As an alternative, a thermal conductivity type of flow indicator can be substituted for the pressure differential type shown in Fig. 1, in which the flow of the sterilizing agent is directed into both a dead end passage, as well as into a through passage, and a heating element and thermistor are located within each passage. As the liquid within the dead end pas-

sage is under static conditions, the difference in temperature in the two passages serves as an indication of the flow rate of the liquid within the through passage.

5 Located in line 3 between the valve 8 and the injector unit 4 is a check valve 14 which permits flow of the sterilizing agent in a direction toward the injector unit 4 but prevents flow in the opposite direction.

10 The injector unit 4 includes a generally T-shaped housing 15 and an L-shaped conduit 16 is connected to line 3 and extends within the housing. The outer section of conduit 16 is aligned axially with line 1, and a resilient head 17, formed of rubber or a rubber-like material, is attached to the outer end of the conduit 16. Head 17 is provided with an internal flange 18 which is received within an annular groove in conduit 16, and the head is clamped to the conduit by a band 19. The sterilizing material is discharged from conduit 16 into the chamber defined by head 17 and then passes through slit 20 in the head to the line 1.

25 As the sterilizing material in line 3 is under a pressure greater than the pressure of the material in line 1, the pressure differential will open or expand the slit 20 and permit the sterilizing material to enter the flow stream of the perishable material in line 1. However, the slit 20 provides a positive shut-off in the event of a malfunction, and prevents the perishable material from line 1 from entering the conduit 16 and line 3.

35 The flow measuring unit 13 generates an output signal proportionate to the flow of sterilizing material in line 3 and this signal is fed to a totalizer unit 21 that serves to provide a continuous cumulative total of the volume of flow of sterilizing agent flowing within the line 3.

The output signal from the unit 13 is also transmitted to a conventional pen-type recorder 22 to provide a continuous reading of the flow of the sterilizing agent in line 3 and, in addition, the output signal from unit 13 is transmitted to a multiplier-divider unit 23.

50 Flow meter 2, which measures the flow of perishable material in line 1, also generates an output signal which is fed to a signal converter unit 24 having a reading scale which provides a visual indication of the flow of perishable material in line 1. The output signal from flow meter 2 is also fed to a totalizer unit 25 which provides a cumulative total of the volume of perishable material flowing in line 1.

65 The output signal from the signal converter unit 24 is fed to the recording unit 22 and to the multiplier-divider unit 23. The multiplier-divider unit 23 serves to divide the flow rate of sterilizing agent by the flow rate of the perishable material to thereby calculate, in parts per million, the actual proportion or concentration of sterilizing agent being introduced

into the perishable material in flow line 1.

The output signal from the multiplier-divider unit 23 is fed to the controller unit 26 which compares the actual proportional flow with the preset proportional flow and acts to generate an "error" or feedback signal proportional to the difference between the actual and preset values. The error signal of controller 26 is fed back to the valve 8 to correspondingly adjust the valve 8 to provide the desired rate of flow of the sterilizing agent through line 3 to the injector unit 4.

In addition, the signal from the controller 26 is also fed to the recorder 22 to provide a continuous visual indication of the proportional flow or concentration, in ppm, of the sterilizing agent in the perishable liquid.

The signal from the controller 26 is also fed to an alarm meter 27, and the alarm meter is provided with settings for both minimum and maximum limits of concentration which straddle the concentration range. If the actual concentration of the sterilizing agent or additive in ppm falls outside of the limits, an alarm is given which will indicate to the operator that the concentration of the additive is outside of the limits. As a further safety precaution, if the concentration of the additive lies above the maximum limit, a switch connected in the electric circuit with the filling machine will be opened to stop the operation of the machine, and a signal will also be transmitted to the valve 8 to close the valve and prevent flow of the additive or sterilizing agent in line 3. This ensures that there will be no flow of either the perishable material or the additive if the concentration of the additive is above the maximum set limit.

The present invention provides an effective method of continuously dissolving small amounts of a slightly soluble material in a flow stream of liquid. The additive is automatically introduced into the flow line and the addition is controlled within precise limits of concentration by a feedback system.

While the above description is directed to the addition of a sterilizing agent to a perishable material, such as for example, a beverage containing carbohydrates and/or proteins and subject to fermentation through enzymatic decomposition, the process can be utilized to add any slightly soluble additive to a liquid flow stream in a continuous process.

We are aware of the Preservatives in Food Regulations, 1962, number 1532, and make no claim to the use of the invention in contravention of these Regulations.

#### WHAT WE CLAIM IS:—

1. An apparatus for blending a liquid additive into a liquid material, comprising first conduit means to convey a stream of the liquid material, injector means located in the first conduit means for injecting the liquid additive into the stream, a storage tank to contain the liquid additive, means for subjecting the addi-

5 tive to an inert gas at a pressure above that  
of the liquid material in the first conduit  
means, second conduit means connecting the  
storage tank to the injector means, said injector  
means including means for atomizing the addi-  
10 tive in the flow stream of the liquid material,  
and mechanical agitating means in the first  
conduit means for agitating the stream of  
liquid material after the introduction of the  
additive.

15 2. Apparatus according to claim 1 including  
means associated with said injector means for  
preventing the flow of the liquid material into  
the second conduit means.

20 3. Apparatus according to claim 1 or 2 in-  
cluding check valve means located in the sec-  
ond conduit means between the injector means  
and the storage tank and separate from the  
injector means for permitting the flow of the  
liquid additive in a direction from the storage  
25 tank to the injector means and for preventing  
flow in the opposite direction.

30 4. Apparatus according to claim 1, 2 or 3  
including valve means in the second conduit  
means, first signal generating means for  
measuring the flow rate of the liquid material  
in the first conduit means and generating a  
first output signal in proportion to said flow  
rate, second signal generating means for  
35 measuring the flow rate of the additive in the  
second conduit means and generating a second  
output signal in proportion to the flow rate  
of said additive, means for comparing the first  
output signal with the second output signal and  
40 generating a third output signal proportional  
to the actual proportional flow rate of the addi-  
tive with respect to the liquid, means for com-  
paring the actual proportional flow rate with  
a preset proportional flow rate and generating  
45 a fourth signal in proportion to the difference  
therebetween, and means for feeding the fourth  
signal to the valve means to control the flow  
of additive in the second conduit means to  
maintain a substantially uniform concentration  
of additive in the flow stream of the liquid  
material.

50 5. Apparatus according to claim 4 including  
alarm means having settings for minimum and  
maximum limits of concentration, and means  
for supplying the fourth signal to the alarm  
means, the alarm means being adapted to be  
actuated to give an alarm if the concentration  
of additive falls outside of said limits.

55 6. A method of blending a liquid additive  
into a flow stream of a liquid material, com-  
prising the steps of continuously caus-  
ing a stream of liquid material to  
flow through a flow path, subjecting  
a body of the liquid additive to the  
60 pressure of an inert gas, said pressure being  
above that of the liquid material in the stream,  
continuously withdrawing additive from said  
body and conducting it to the stream of liquid  
material, atomizing the additive in the stream,  
65 and mechanically agitating the stream after the  
introduction of the additive.

7. A method according to claim 6 wherein  
the liquid material is perishable and the liquid  
additive is a sterilizing agent.

70 8. A method according to claim 7 wherein  
the sterilizing agent is slightly soluble in the  
perishable liquid.

75 9. A method according to claim 8 wherein  
the perishable liquid material includes a water  
phase and the sterilizing agent is less than 1%  
by weight soluble in the water phase at 20°C.

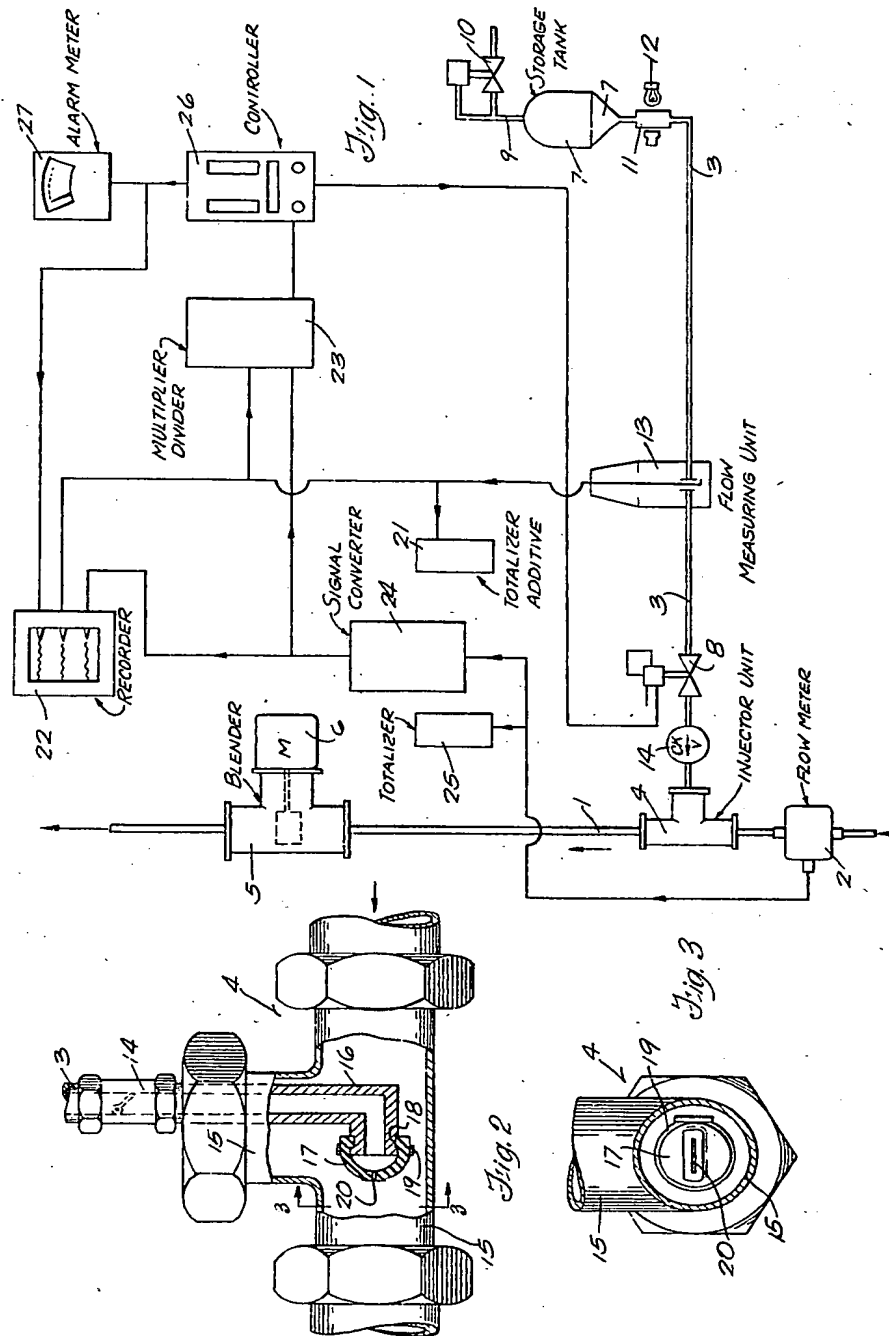
80 10. A method according to any of claims  
6 to 9 wherein the inert gas pressure is at  
least 5 p.s.i. above that of the liquid material  
in the stream.

11. A method of blending sterilising agent  
into a flow stream of perishable liquid substan-  
tially as hereinbefore described with reference  
to the accompanying drawing.

85 12. Apparatus for blending sterilising agent  
into a flow stream of perishable liquid substan-  
tially as hereinbefore described with reference  
to the accompanying drawing.

REDDIE & GROSE  
Agents for the Applicants

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1972.  
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from  
which copies may be obtained.



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